What is claimed is:

1. A plasma reactor for use with a supply of RF source power for processing a workpiece, said reactor comprising:

a vacuum chamber having a ceiling;

a workpiece support pedestal within the chamber facing said ceiling and comprising a top pedestal surface having a diameter similar to a diameter of a workpiece to be supported thereon, said chamber having an axis of symmetry intersecting said ceiling and intersecting said top pedestal surface, said ceiling having a diameter greater than said diameter of said top pedestal surface;

a first single solenoidal interleaved coil antenna at least generally coaxial with said axis of symmetry, the entirety thereof overlying an intermediate portion of the ceiling between a periphery of the ceiling and a center of the ceiling, the entirety of said first single solenoidal interleaved coil antenna having a diameter substantially less than the diameter of said top pedestal surface, and comprising a first plurality of conductors wound about said axis of symmetry in respective concentric helical solenoids, said conductors being displaced from said axis of symmetry in a lateral direction uniformly, the conductors being offset from one another in the direction generally of the axis of symmetry, each of said conductors being connected across said supply RF source power; and

an outer coil antenna overlying the ceiling and having a lateral extent greater than said first solenoidal interleaved conductor coil antenna, whereby said first solenoidal interleaved conductor coil antenna is an inner coil antenna.

2. The reactor of Claim 1 further comprising a second RF plasma source power supply connected to said outer coil antenna whereby the respective RF power levels applied to said inner and outer antennas are differentially adjustable

to control radial distribution of the applied RF field from said inner and outer antennas.

3. The reactor of Claim 1 wherein said first RF plasma source power supply comprises two RF outputs having differentially adjustable power levels, one of said two RF outputs being connected to said outer antenna and the other being connected to said inner antenna, whereby the respective RF power levels applied to said inner and outer antennas are differentially adjustable to control radial distribution of the applied RF field from said inner and outer antennas.

4. The reactor of Claim 1 wherein said outer antenna comprises a second solenoidal interleaved conductor coil antenna overlying the ceiling and comprising a second plurality of conductors wound about said axis of symmetry in concentric helical solenoids, and wherein the number of said second plurality of conductors is greater than the number of said first plurality of conductors and the lengths of said second plurality of conductors are shortened accordingly, so as to bring the inductive reactance of said outer antenna at least nearer that of said inner antenna.

5. The reactor of Claim 1 wherein said outer antenna comprises a second solenoidal interleaved conductor coil antenna overlying the ceiling and comprising a second plurality of conductors wound about said axis of symmetry in concentric helical solenoids of at least nearly uniform lateral displacements from said axis of symmetry but greater than that of said inner antenna, the conductors in each helical solenoid being offset from the conductors in the other helical solenoids in a direction parallel to said axis of symmetry.

6. The reactor of Claim 5 wherein the number of said second plurality of conductors of said outer antenna is

greater than the number of said first plurality of conductors of said inner antenna.

7. The reactor of Claim 5 wherein the number of said second plurality of parallel conductors is greater than the number of said first plurality of parallel conductors and the lengths of said second plurality of parallel conductors are shortened accordingly, so as to bring the inductive reactance of said outer antenna at least nearer that of said inner antenna.

8. The reactor of Claim 7 wherein the number of said second plurality of conductors is sufficient to compensate for their shortened lengths relative to said first plurality of conductors.

9. The reactor of Claim 8 wherein the number of said second plurality of conductors is twice the number of said first plurality of conductors.

10. The reactor of Claim 5 wherein the lateral displacements of said second plurality of conductors of said outer antenna are uniform and the lateral displacements of said first plurality of conductors of said inner antenna are uniform, whereby said inner and outer antennas are confined within respective narrow annuli of widths corresponding to the thickness of said conductors, whereby to maximize the differential effect of said inner and outer antennas on the radial distribution of applied RF field.

11. The reactor of Claim 10 wherein said chamber and said inner and outer antennas are cylindrical.

12. The reactor of Claim 11 wherein said lateral displacements of said second and first pluralities of conductors are outer and inner radii, respectively, overlying peripheral and center regions of said chamber, respectively.

13. The reactor of Claim 5 wherein:

said inner coil antenna lies between top and bottom inner planes generally perpendicular to said axis of symmetry, the helical solenoid defined by each conductor of said inner antenna being terminated at a top point of the conductor near said top inner plane and a bottom point of the conductor near said bottom inner plane;

said outer coil antenna lies between top and bottom outer planes generally perpendicular to said axis of symmetry, the helical solenoid defined by each conductor of said outer antenna being terminated at a top point of the conductor near said top outer plane and a bottom point of the conductor near said bottom outer plane.

14. The reactor of Claim 13 wherein:

said top points of said outer antenna are angularly displaced from one another by about 360/n, wherein n is the number of said plural conductors of the outer coil antenna;

said top points of said inner antenna are angularly displaced from one another by about 360/m, wherein m is the number of said plural conductors of the inner coil antenna.

15. The reactor of Claim 14 wherein:

said bottom points of said outer antenna are angularly displaced from one another by about 360/n, wherein n is the number of said plural conductors of the outer coil antenna;

said bottom points of said inner antenna are angularly displaced from one another by about 360/m, wherein m is the number of said plural conductors of the inner coil antenna; and

the top and bottom points of each of said conductors are in alignment along a direction parallel to axis of symmetry.

16. The reactor of Claim 15 further comprising:

an inner annular RF power conductor bus in said top inner plane and having a radius generally the same as that of said inner antenna, said top points of said inner antenna being connected to said inner annular RF power conductor bus;

an outer annular RF power conductor bus in said top outer plane and having a radius generally the same as that of said outer antenna, said top points of said outer antenna being connected to said outer annular RF power conductor bus.

17. The reactor of Claim 14 wherein n is an integral multiple of m and wherein n/m of the top points of said outer antenna are in angular alignment with the top points of said inner antenna.

18. The reactor of Claim 15 wherein said top points and bottom points are spaced equally with respect to an axis of symmetry of said reactor and with respect to one another.

19. The reactor of Claim 18 wherein said conductors are evenly spaced with respect to one another and with respect to the axis of symmetry and are of substantially the same shape.

20. The reactor of Claim 14 wherein the conductors of said antenna are generally mutually parallel.

21. The reactor of Claim 1 wherein said solenoidal antenna is rectangular.

22. The reactor of Claim 1 wherein said inner coil antenna lies between top and bottom planes generally perpendicular to said axis of symmetry, the helical solenoids defined by respective conductors being terminated at respective top points of the conductor near said top plane and respective bottom points of the conductor near

said bottom plane, said RF power source being connected across said top and bottom points of each of said conductors, wherein said top points are azimuthally equally spaced and said bottom points are azimuthally equally spaced.

23. The reactor of Claim 1 wherein said inner coil antenna lies between a top and bottom planes generally perpendicular to said axis of symmetry, the helical solenoids defined by respective conductors being terminated at respective top points of the conductors near said top plane and respective bottom points of the conductors near said bottom plane, said power source being connected across said top and bottom points of each of said conductors, wherein corresponding ones of said top and bottom points are in axial alignment.

24. A plasma reactor for use with a supply of RF source power for processing a workpiece, said reactor comprising:

a vacuum chamber having a ceiling, said ceiling having a ceiling diameter;

a workpiece support pedestal within the chamber facing said ceiling and comprising a top pedestal surface, said chamber having an axis of symmetry intersecting said ceiling and intersecting said top pedestal surface, said ceiling having a diameter greater than a diameter of said top pedestal surface;

a first single solenoidal interleaved coil antenna at least generally coaxial with said axis of symmetry, the entirety thereof overlying an intermediate portion of the ceiling between a periphery of the ceiling and a center of the ceiling, the entirety of said first single solenoidal interleaved coil antenna having a diameter substantially less than said ceiling diameter, and comprising a first plurality of conductors wound about said axis of symmetry in

respective concentric helical solenoids, said conductors being displaced from said axis of symmetry in a lateral direction uniformly, the conductors being offset from one another in the direction generally of the axis of symmetry, each of said conductors being connected across said supply of RF source power.

25. The reactor of Claim 24 wherein said coil antenna lies between top and bottom planes generally perpendicular to said axis of symmetry, the helical solenoids defined by respective conductors being terminated at respective top points of the conductors near said top plane and respective bottom points of the conductors near said bottom plane, said RF power source being connected across said top and bottom points of each of said conductors.

26. The reactor of Claim 25 wherein said top points are connected to an output terminal of said RF power source and said bottom points are grounded so as to reduce the electric potential near said ceiling.

27. The reactor of Claim 25 wherein said top points are angularly displaced from one another by about 360/n, wherein n is the number of said plural conductors of the coil antenna.

28. The reactor of Claim 27 wherein said bottom points are angularly displaced from one another by about 360/n, wherein n is the number of said plural conductors of the coil antenna.

29. The reactor of Claim 28 wherein said top points are co-planar and lie in said top plane.

30. The reactor of Claim 29 wherein said bottom points are co-planar and lie in said bottom plane.

31. The reactor of Claim 30 wherein said bottom plane is nearly co-planar with a top surface of said ceiling.

32. The reactor of Claim 25 wherein said top and bottom ends of each of said conductors are co-linear in a direction parallel to said axis of symmetry.

33. The reactor of Claim 24 wherein said helical solenoids of said plural conductors are cylindrical, said lateral extent being the diameter of said helical solenoids, whereby the first single solenoidal interleaved coil antenna defines a right cylinder.

34. The reactor of Claim 24 further comprising a plasma bias RF power supply connected to said workpiece support pedestal.

35. The reactor of Claim 24 wherein said plasma source power supply comprises a source RF generator and an impedance match network connected between said source RF generator and said first single solenoidal antenna.

36. The reactor of Claim 34 wherein said plasma bias power supply comprises bias a RF generator and an impedance match network connected between said bias RF generator and said workpiece support pedestal.

37. The reactor of Claim 24 further comprising:

an inner coil antenna overlying the ceiling and surrounded by and having a lateral extent less than said first solenoidal interleaved conductor coil antenna, whereby

said first solenoidal interleaved conductor coil antenna is an outer coil antenna.

38. The reactor of Claim 37 further comprising a second RF plasma source power supply connected to said inner coil antenna whereby the respective RF power levels applied to said inner and outer antennas are differentially adjustable to control radial distribution of the applied RF field from said inner and outer antennas.

39. The reactor of Claim 37 wherein said first RF plasma source power supply comprises two RF outputs having differentially adjustable power levels, one of said two RF outputs being connected to said outer antenna and the other being connected to said inner antenna, whereby the respective RF power levels applied to said inner and outer antennas are differentially adjustable to control radial distribution of the applied RF field from said inner and outer antennas.

40. The reactor of Claim 37 wherein said inner antenna comprises a second solenoidal interleaved conductor coil antenna overlying the ceiling and comprising a second plurality of conductors wound about said axis of symmetry in concentric helical solenoids, and wherein the number of said first plurality of conductors is greater than the number of said second plurality of conductors and the lengths of said first plurality of conductors are shortened accordingly, so as to bring the inductive reactance of said outer antenna at least nearer that of said inner antenna.

41. The reactor of Claim 37 wherein said inner antenna comprises a second solenoidal interleaved conductor coil antenna overlying the ceiling and comprising a second

plurality of conductors wound about said axis of symmetry in concentric helical solenoids of at least nearly uniform lateral displacements from said axis of symmetry but less than that of said outer antenna, the conductors in each helical solenoid being offset from the conductors in the other helical solenoids in a direction parallel to said axis of symmetry.

42. The reactor of Claim 41 wherein the number of said first plurality of conductors of said outer antenna is greater than the number of said second plurality of conductors of said inner antenna.

43. The reactor of Claim 42 wherein the number of said first plurality of parallel conductors is greater than the number of said second plurality of parallel conductors and the lengths of said first plurality of parallel conductors are shortened accordingly, so as to bring the inductive reactance of said outer antenna at least nearer that of said inner antenna.

44. The reactor of Claim 43 wherein the number of said first plurality of conductors is sufficient to compensate for their shortened lengths relative to said second plurality of conductors.

45. The reactor of Claim 44 wherein the number said first plurality of conductors is twice the number of said second plurality of conductors.

46. The reactor of Claim 41 wherein the lateral displacements of said first plurality of conductors of said outer antenna are uniform and the lateral displacements of said second plurality of conductors of said inner antenna

are uniform, whereby said inner and outer antennas are confined within respective narrow annuli of widths corresponding to the thickness of said conductors, whereby to maximize the differential effect of said inner and outer antennas on the radial distribution of applied RF field.

47. The reactor of Claim 46 wherein said chamber and said inner and outer antennas are cylindrical.

48. The reactor of Claim 47 wherein said lateral displacements of said first and second pluralities of conductors are outer and inner radii, respectively, overlying peripheral and center regions of said chamber, respectively.

49. The reactor of Claim 41 wherein:

said inner coil antenna lies between top and bottom inner planes generally perpendicular to said axis of symmetry, the helical solenoid defined by each conductor of said inner antenna being terminated at a top point of the conductor near said top inner plane and a bottom point of the conductor near said bottom inner plane;

said outer coil antenna lies between top and bottom outer planes generally perpendicular to said axis of symmetry, the helical solenoid defined by each conductor of said outer antenna being terminated at a top point of the conductor near said top outer plane and a bottom point of the conductor near said bottom outer plane.

50. The reactor of Claim 49 wherein:

said top points of said outer antenna are angularly displaced from one another by about 360/n, wherein n is the number of said plural conductors of the outer coil antenna;

said top points of said inner antenna are angularly displaced from one another by about 360/m, wherein m is the number of said plural conductors of the inner coil antenna.

51. The reactor of Claim 50 wherein:

said bottom points of said outer antenna are angularly displaced from one another by about 360/n, wherein n is the number of said plural conductors of the outer coil antenna;

said bottom points of said inner antenna are angularly displaced from one another by about 360/m, wherein m is the number of said plural conductors of the inner coil antenna; and

the top and bottom points of each of said conductors are in alignment along a direction parallel to axis of symmetry.

52. The reactor of Claim 51 further comprising:

an inner annular RF power conductor bus in said top inner plane and having a radius generally the same as that of said inner antenna, said top points of said inner antenna being connected to said inner annular RF power conductor bus;

an outer annular RF power conductor bus in said top outer plane and having a radius generally the same as that of said outer antenna, said top points of said outer antenna being connected to said outer annular RF power conductor bus.

53. The reactor of Claim 50 wherein n is an integral multiple of m and wherein n/m of the top points of said outer antenna are in angular alignment with the top points of said inner antenna.

54. The reactor of Claim 25 wherein said top points and bottom points are spaced equally with respect to an axis of symmetry of said reactor and with respect to one another.

55. The reactor of Claim 24 wherein said conductors are evenly spaced with respect to one another and with respect to the axis of symmetry ad are of substantially the same shape.

56. The reactor of Claim 24 wherein the conductors of said antenna are generally mutually parallel.

57. The reactor of Claim 24 wherein said solenoidal antenna is rectangular.

58. The reactor of Claim 25 wherein said top points are azimuthally equally spaced and said bottom points are azimuthally equally spaced.

59. The reactor of Claim 25 wherein corresponding ones of said top and bottom points are in axial alignment.